E-MRS – IUMRS – ICEM 2000

SYMPOSIUM L

Sub-Quarter-Micron Silicon Issues in the 200/300 mm Conversion Era

May 30 – June 2, 2000

Symposium Organizers:

Hans Richter, Institute for Semiconductor Physics, Frankfurt (Oder), Germany

Hermann Fußtetter, Wacker Siltronic AG, Germany

Masataka Umeno, Osaka University, Japan

Symposium Support:

Wacker Siltronic AG, Germany

Papers will be published in Microelectronic Eng

E-MRS 2000 SPRING MEETING

SYMPOSIUM L

Tuesday, May 30, 2000 **Afternoon**
Mardi 30 mai 2000 Après-midi

13:50 **OPENING REMARKS**
H. Richter, IHP, Frankfurt (Oder)

Session I - New Materials 1
Chairperson: G. Ritter, IHP, Frankfurt (Oder), Germany

L-I.1 14:00 **Invited** NEW MATERIALS FOR ACTIVE AND PASSIVE INTEGRATED DEVICES FOR WIRELESS APPLI-CATIONS, P. Gill, **M. Miller** and B.Y. Nguyen, Motorola SPS DigitalDNA Labs, USA

L-I.2 14:30 COPPER FILMS PRODUCED BY CHEMICAL VAPOR DEPOSITION - THE EFFECT OF NUCLEATION ON SURFACE ROUGHNESS AND VOID FORMATION, R. Kroeger, E. Rabkin and M. Eizenberg, Department of Materials Engineering, Technion - Israel Institute of Technology, 32000 Haifa, Israel, D. Cong and L. Chen, Applied Materials Inc., Santa Clara, USA

L-I.3 14:50 CHEMICAL-MECHANICAL POLISHING OF ELECTRO-PLATING COPPER THIN FILM FOR ULSI INTERCONNECTS DAMASCENE PROCESS, S.-Y. Chiu, K.-Ch. Lin, S.-J. Chang, C.-F. Chen and M.-S. Feng, Institute of Materials Science and Enginnering, National Chiao Tung University, Taiwan, Y.-L. Wang, Taiwan, R.O.C., Semiconductor Manufacturing Company, Taiwan, J.-M. Shieh and B.-T. Dai, National Nano Device Laboratories, Taiwan, R.O.C.

L-I.4 15:10 DETERMINATION OF ELECTROLESS KINETIC. AN QCM STUDY, A. Zouhou, H. Vergnes and P. Duverneuil, Laboratoire de Génie Chimique, Toulouse Cedex, France

L-I.5 15:30 TiN BARRIERS FOR HIGH-k CAPACITORS - SIMULATIONS AND EXPERIMENTAL RESULTS, T. Theiler, N. Sacher and B. Fröschle, STEAG RTP Systems GmbH, Dornstadt, Germany

15:50 **BREAK**

Session I - New Materials 2
Chairperson: H. Tu, General Research Institute for Non-ferrous Metals, Beijing

L-I.6 16:10 A STUDY ON THE MICROSTRUCTURES AND ELECTRICAL PROPERTIES OF CeO_2 FILMS FOR GATE DIELECTRICS APPLICATIONS, J.-H. Yoo, S.-W. Nam, S.-H. Lee, S.-K. Kang, D.-H. Ko, Dept of Ceramic Engineering, Yonsei Univ., Seoul, Korea and H.-J. Lee, Dept of Materials Sci. & Eng. Stanford Univ. Stanford, CA, USA

L-I.7 16:30 CRYSTAL- ORIENTATION CONTROLLED EPITAXIAL CEO2 HIGH K DIELECTRIC THIN FILMS ON SI (100) SUBSTRATES USING PULSED LASER DEPOSITION, J. Kang, X. Liu, X. Guan, R. Han, Y. Wang, Institute of Microelectronics, Peking University, G. Lian and G. Xiong, Department of Physics, Peking University, P.R. China

L-I.8 16:50 POROUS ALUMINA AS LOW-K DIELECTRIC ON 200 MM SILICON WAFERS, S. Lazarouk, S. Katsouba, Belarusian State University Informatics and Radioelectronics, Minsk, Belarus, A. Demianovich, V. Stanovski, V. Vysotzki and V. Ponomar, Research and Design Company Belmicrosystems, Minsk, Belarus

L-I.9 17:10 A NOVEL APPROACH TO ULTRA-THIN OXIDE GROWTH BY RAPID THERMAL NITRIDATION/OXIDATION, V.G. Litovchenko, A.A. Efremov, Institute of Semiconductor Physics, Kiev, Ukraine and H. Richter, IHP, Frankfurt (Oder), Germany

Wednesday, May 31, 2000 — Afternoon

Mercredi 31 mai 2000 — Après-midi

Session II - Conversion to 300 mm Si Wafers 1
Chairperson: H. Fußstetter, Wacker-Siltronic AG, Burghausen, Germany

L-II.1 14:00 **Invited** 300 MM WAFER- A COST AND TECHNOLOGY CHALLENGE, **P. Hahn**, Wacker-Siltronic, Burghausen, Germany

L-II.2 14:30 **Invited** EVALUATIONS OF 300 mm Si WAFER PERFORMANCES FOR GIGA ULSI DEVICE PROCESSES, **K. Takahashi** and K. Kawashima, Semiconductor Leading Edge Technologies, Inc., Yokohama, Japan

L-II.3 15:00 **Invited** WAFER QUALITY AND WAFER COST BALANCE IN CURRENT AND FUTURE SILICON TECHNOLOGIES, **K.V. Ravi**, Intel, Santa Clara, USA

15:30 **BREAK**

Session II - Conversion to 300 mm Si Wafers 2
Chairperson: K.V. Ravi, Intel, Santa Clara, USA

L-II.4 16:00 **Invited** PRODUCTION MATURITY OF 64/256 M FURNACE AND RTP PROCESSES ON 300 mm WAFERS, **M. Stadtmüller**, SC300, Dresden, Germany

L-II.5 16:30 **Invited** EQUIPMENT DEVELOPMENT FOR THE NEXT GENERATION WAFERSIZE OF 300 mm, **J. Sanches-Moreno**, Applied Materials, Germany

L-II.6 17:00 EUROPEAN 300 mm METROLOGY PLATFORM – MEDEA T618, A. Reader, Philips Analytical, Almelo, The Netherlands, J. Trilhe and L. Kwakman, STMicroelectronics, Crolles, France

L-II.7 17:20 ENVIRONMENTALLY FRIENDLY WAFER PRODUCTION: NF3 REMOTE MICROWAVE PLASMA FOR CHAMBER CLEANING, K. Schober, Wacker Siltronic AG, Burghausen, Germany, H. Reichardt and A. Frenzel, DAS GmbH, Dresden, Germany

L-II.8 17:40 COST REDUCTION STRATEGIES FOR WAFER EXPENDITURE, L. Pfitzner, C. Schneider, Fraunhofer Institute of Integrated Circuits, Erlangen, Germany and H.-M. Dudenhausen, iSiltec GmbH, Erlangen, Germany

Thursday, June 1, 2000 — Morning

Jeudi 1er juin 2000 — Matin

Session III - Material Properties of 300 mm Si 1
Chairperson: V. V. Voronkov, MEMC, Electronic Materials, Merano, Italy

L-III.1 09:00 **Invited** THE GROWTH TECHNOLOGY FOR 300 MM SINGLE CRYSTAL SILICON, **H. Tu**, Q. Zhou, G. Zhang, Q. Chang, F. Fang, Z. Wu, G. Wan and J. Wang, General Research Institute for Non-ferrous Metals, Beijing, P.R. China

L-III.2 09:30 EFFECTS OF VARIOUS MAGNETIC FIELD CON-FIGURATIONS ON TEMPERATURE DISTRIBUTIONS IN CZOCHRALSKI SILICON MELTS, O. Gräbner, G. Müller, Crystal Growth Laboratory, at the Department of Materials Science, University Erlangen-Nürnberg and Fraunhofer Institute IIS-B, Erlangen, Germany, J. Virbulis, E. Tomzig and W. v. Ammon, Wacker Siltronic AG, Burghausen, Germany

L-III.3 09:50 GROWTH AND STRESS ANALYSIS OF NECKS FOR 300 mm CZ SILICON SINGLE CRYSTALS, H. Tu, Q. Chang, Q. Zhou, G. Zhang, Z. Wu. G. Wan, F. Fang, J. Wang and Z. Luo, General Research Institute for Non-ferrous Metals, Beijing, P.R. China

L-III.4 10:10 COMPARISON OF SILICON EPITAXIAL GROWTH ON THE 200 AND 300 mm WAFERS FROM TRICHLOROSILANE IN CENTURA REACTORS, A.S. Segal, Institute for Fine Mechanics and Optics, St. Petersburg, Russia; A.O. Galyukov, A.V. Kondratyev, A.P. Sidíko, S.Yu. Karpov, Soft Impact Ltd, St. Petersburg, Russia; Yu.N. Makarov, Fluid Mechanics Institute, University of Erlangen-Nurnberg, Erlangen, Germany; W. Siebert and P. Storck, Wacker Siltronic AG, Burghausen, Germany

10:30 **BREAK**

Session III - Material Properties of 300 mm Si 2
Chairperson: N. Inoue, Osaka Prefectural University, Osaka, Japan

L-III.5 11:00 **Invited** MECHANICAL PROPERTIES OF 300 MM WAFERS, **M. Akatsuka**, K. Sueoka, N. Adachi, N. Morimoto and H. Katahama, Sumitomo Metal Industries, Amagasaki, Japan

L-III.6 11:30 **Invited** ISSUES FOR THE LARGER DIAMETER EPITAXIAL WAFER, **M. Imai**, M. Mayusumi, K. Inoue, S. Nakahara and S. Gima, Super Silicon Crystal Research Institute Corp., Gumma, Japan

L-III.7 12:00 UPPER YIELD POINT OF LARGE DIAMETER SILICON, A. Fischer, H. Richter, IHP, Frankfurt (Oder), Germany, and A. Shalynin, Institute of Solid State Physics of RAS, Chernogolovka, Russia

12:20 **LUNCH**

Thursday, June 1, 2000 — Afternoon

Jeudi 1er juin 2000 — Après-midi

Session IV - Defect Engineering 1
Chairperson: M. Umeno, Osaka University, Osaka, Japan

L-IV.1 14:00 DIFFERENT TECHNIQUES FOR ANALYSING NANOTOPOLOGY AND WAVINESS ON SILICON WAFERS, T. Müller, R. Kumpe, R. Schmolke, F. Passek, H. Gerber and P. Wagner, Wacker Siltronic AG, Burghausen, Germany

L-IV.2 14:20 RELATION BETWEEN TEMPERATURE GRADIENT AND GROWTH RATE IN CZ SILICON, T. Higashino, K. Tanahashi and N. Inoue, RIAST, Osaka Prefecture University, Japan

L-IV.3 14:40 EQUILIBRIUM POINT DEFECT CONCENTRATION IN A GROWING SILICON CRYSTAL, K. Tanahashi, N. Inoue, T. Higashino, RIAST, Osaka Prefecture University and N. Akutsu, Faculty of Engineering, Osaka Electro-Communication University, Japan

L-IV.4 15:00 GLOBAL MODEL OF CZOCHRALSKI SILICON GROWTH TO PREDICT OXYGEN CONTENT AND THERMAL FLUCTUATIONS AT THE MELT-CRYSTAL INTERFACE, I.Yu. Evstratov, V.V. Kalaev, V.N. Nabokov, Soft-Impact Ltd., St. Petersburg, Russia, A.I. Zhmakin, A.F. Ioffe Physical Technical Institute, St. Petersburg, Russia, Yu.N. Makarov, Fluid Mechanics Institute, University of Erlangen-Nuernberg, Germany, N.G. Ivanov , E.A. Rudinsky, E.M. Smirnov, State Technical University, St. Petersburg, Russia, S.A. Lowry, CFD Research Corporation, Huntsville, USA, E. Dornberger, J. Virbulis, E. Tomzig and W. v. Ammon, Wacker Siltronic, Burghausen, Germany

L-IV.5 15:20 AN IN-SITU X-RAY TOPOGRAPHY OBSERVATION OF DISLOCATIONS, CRYSTAL-MELT INTERFACE AND MELTING OF SILICON, Y. Wang and K. Kakimoto, Institute of Advanced Material Study, Kasuga, Japan

15:40 **BREAK**

Session IV - Defect Engineering 2
Chairperson: H. Richter, IHP, Frankfurt (Oder), Germany

L-IV.6 16:00 DISSOLUTION RATE OF SILICA IN SILICON MELT: PRESENTATION OF A NEW OPTICAL IN-SITU MEASUREMENT TECHNIQUE AND COMPARISON TO EX-SITU RESULTS, A. Mühe and G. Müller, Crystal Growth Laboratory, at the Department of Materials Science, University Erlangen-Nürnberg and Fraunhofer Institute IIS-B, Erlangen, Germany

L-IV.7 16:20 ENHANCEMENT OF GETTERING EFFICIENCIES OF DIFFERENT SILICON SUBSTRATES DURING A 0.18 µm LTB CMOS PROCESS SIMULATION - STRATIGRAPHY BY A NOVEL CHEMICAL ULTRA-TRACE DEPTH-PROFILING, R. Hoelzl, K.-J. Range, Institute of Inorganic Chemistry, University of Regensburg, Regensburg, Germany; L. Fabry, R. Wahlich, Wacker Siltronic AG, Burghausen, Germany; and G. Kissinger, IHP, Frankfurt (Oder), Germany

L-IV.8 16:40 INTRINSIC GETTERING OF 300 MM CZ WAFERS, F. Bialas, R. Winkler and H. Dietrich, Infineon Technologies AG, Munich, Germany

L-IV.9 17:00 EFFECT OF DOPING ON POINT DEFECT INCORPORATION DURING SILICON GROWTH, V.V. Voronkov, MEMC Electronic Materials, Merano, Italy and R. Falster, MEMC Electronic Materials, Novara, Italy

Friday, June 2, 2000 **Morning**
Vendredi 2 juin 2000 Matin

Session V - Alternative Substrates and Technology
Chairperson: L. Pfitzner, Fraunhofer-Institute of Integrated Circuits, Erlangen, Germany

L-V.1	9:00	**Invited**	CAN Si(113) WAFERS BE AN ALTERNATIVE TO Si(001)?, **H.-J. Muessig**, J. Dabrowski, K.-E. Ehwald, P. Gaworzewski, IHP, Im Technologiepark 25, 15236 Frankfurt (Oder), Germany and A. Hubert, U. Lambert, Wacker Siltronic AG, P.O. Box 1140, 84479 Burghausen, Germany
L-V.2	9:30		TEM OBESERVATION OF OXYGEN PRECIPITATES IN NITROGEN-DOPED SILICON, D. Yang, X. Ma, R. Fan, L. Li and D. Que, State Key Lab of Silicon Material Science, Zhejiang University, P.R. China
L-V.3	9:50		WIDER LATITUDE FOR SOPHISTICATED BY INCORPORATING CARBON INTO CRYSTALLINE Si OR SiGe, H.-J. Osten, H. Rücker, J.P. Liu and B. Heinemann, IHP, Frankfurt (Oder), Germany
L-V.4	10:10		NOVEL TECHNIQUES FOR THE FABRICATION OF DIELECTRIC LAYERS ON LARGE WAFER SUBSTRATES, J. Reif, D. Wolfframm, T. Arguirov and S. Kouteva-Arguirova, LS Experimentalphysik 2, Brandenburgische Technische Universität Cottbus, Cottbus, Germany
L-V.5	10:30		A 10 NM MOSFET CONCEPT, J. Appenzeller, J. Knoch, II. Physikalisches Institut, RWTH Aachen, Aachen, Germany, J.A. del Alamo, MIT, Cambridge, USA, R. Martel, K. Chan, P. Solomon, Ph. Avouris, IBM, T.J. Watson Research Center, USA, J.L. Liu and K.L. Wang, UCLA, Los Angeles, USA
L-V.6	10:50		IN SITU RAMAN SPECTROSCOPY STUDY ON SILICON SURFACE IN NH_4OH/H_2O_2 AND HCl/H_2O_2 AQUEOUS SOLUTIONS, J. Wang, H. Tu, Q. Zhou, W. Zhu and A. Liu, General Research Institute for Non-ferrous Metals, Beijing, P.R. China
	11:10		CLOSING REMARKS H. Fußstetter, Wacker Siltronic AG, Burghausen
			LUNCH

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